

# Inhibition of Biofilm Formation Using Novel Nanostructured Surfaces, Phase I

Completed Technology Project (2004 - 2006)



## Project Introduction

Biofilms are ubiquitous in the environment. Few surfaces resist biofilm formation, most promote it. Biofilm formation poses problems in water systems as they can clog pipes and pores, block filters, reduce heat transfer, and in general restrict flow. Their metabolic products can aid corrosion, even of stainless steel. In potable water systems, both their metabolic products and the bacteria or fungi themselves directly pose a health hazard. A space environment appears to be a particularly favorable one for biofilm formation. Cell cultures have shown far higher rates of growth in low-gravity environments. Space radiation seems to accelerate microbial growth and foster their mutation. Within a closed environment with many non-replaceable resources, prevention of biofilm formation is paramount. To meet this need, Agave BioSystems and the Universities Space Research Association, propose to develop carbon nanotubes (CNTs) and other nanostructures for the prevention of biofilm growth. In this Phase I, we propose to demonstrate that the use of nanostructured materials can prevent or inhibit growth of biofilms due to geometry effects and that they can also be functionalized with a biocide.

## Anticipated Benefits

Microbial biofilms on surfaces cost the nation billions of dollars yearly in equipment damage, product contamination, energy losses and medical infections. Conventional methods of killing bacteria (such as antibiotics, and disinfection) are often ineffective with biofilm bacteria. The huge doses of antimicrobials required to rid systems of biofilm bacteria are environmentally undesirable (biocides and environmental antimicrobials cost \$1.2 Billion per year) and medically impractical (since what it would take to kill the biofilm bacteria would also kill the patient!). So new strategies based on a better understanding of how bacteria attach, grow and detach are urgently needed by many industries.



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## Table of Contents

Project Introduction	1
Anticipated Benefits	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Management	2
Technology Areas	2

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission  
Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

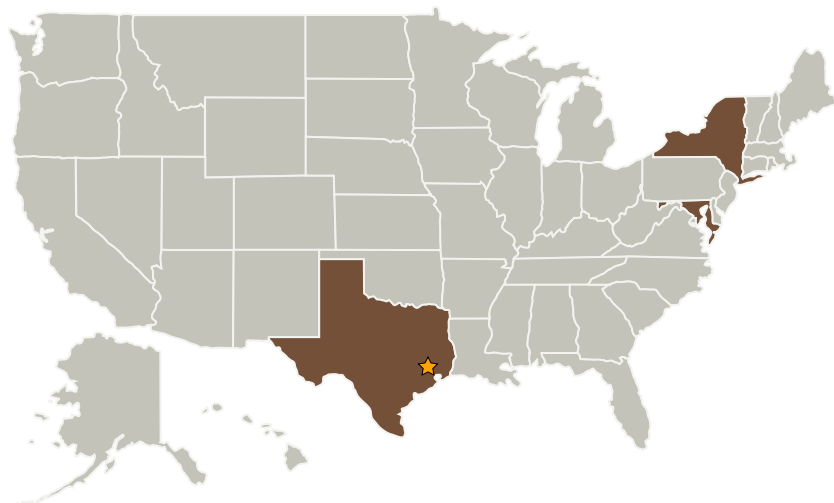
Small Business Innovation  
Research/Small Business Tech  
Transfer

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Agave BioSystems, Inc.	Supporting Organization	Industry	Ithaca, New York
Universities Space Research Association(USRA)	Supporting Organization	R&D Center	Huntsville, Alabama

### Primary U.S. Work Locations

Maryland	New York
Texas	

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Project Manager:

Tom Goodwin

### Principal Investigator:

Joel Tabb

## Technology Areas

### Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.2 Water Recovery and Management